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Cognitive drivers, and the effect of information on climate change adaptive behaviour in Fiji Islands☆

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ABSTRACT

This study investigates the role of cognitive processes and information on climate change adaptive investment choice. Using experimental survey data from the Fiji Islands we found that attitudes, subjective norms, and perceived behavioural control moderated intentions which in turn affected investment stated behaviour. We also found that the correlation between intention and behaviour to be significant only in the presence of information. In addition for those in receipt of information, intention accounted for a greater amount of variance than in the absence of information.

1. Introduction

Small island states represent areas with the highest vulnerability and lowest adaptive capacity to climate change (Nance et al., 2014). These nations, built on fragile ecosystems, account for less than 1% of global GHG emissions and yet they must suffer the full brunt of the consequences elicited by anthropogenic climate change. There is an array of Small Island Developing States (SIDS) resting in the most threatened of the World's 34 biodiversity hotspots (Brooks et al., 2002; Watling and Bottroff, 2011). Fiji compromises one of these SIDS. Fiji and other SIDS are facing an uphill battle against the impact of climate change (Australian Bureau of Meteorology and CSIRO, 2011).[1] In Fiji, for Viti Levu[2] alone, it is estimated that climate related disasters can incur a cost equivalent to between two and four percent of Fiji's GDP by 2050, whilst for other SIDS the costs are far greater (Bettencourt, 2011). The IPCC (2018) notes that small islands are projected to experience high multiple interrelated climate risks at global warming of 1.5 °C above pre-industrial levels with limits to adaptive capacity at higher levels of warming. There is an urgency for inclusive and socially acceptable pathways towards low-carbon and climate-resilient futures for SIDS. Accordingly, SIDS are in need of cost-effective and novel solutions to engage its communities to take up climate adaptive behaviours.

This paper aims to analyze the broader set of motives that shape people's adaptive investment decision under a novel microlending context. It does so through a choice experiment which was preceded by a survey of psychological measures. The study attempted to broaden the notion of the rational economic agent by employing one of the most used socio-psychological theories in the study of behaviour, the Theory of Planned Behaviour (TPB). The choice experiment randomly assigned people living in or near fragile ecosystems in the island of Viti-Levu in Fiji into a treatment and control group and presented them with a microloan to invest in a choice of smallholder farming practices which varied in adaptive value. The treatment group was designed to test whether the provision of climate change information was a determining factor in the uptake of adaptive investments. It consisted of the provision of an information leaflet on the cause, local effects, and adaptive solutions to climate change. By focusing on motivations behind stated behaviour through the framework of the established TPB, this paper offers a new perspective on microlending to finance climate adaptive behaviours. This can be of great utility to the development of new initiatives which hope to instigate behavioural change. Climate change adaptation in smallholders is a policy challenge, and one that will

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[1] Fiji's ecosystems are faced with the anthropogenic threats of over-harvesting, pollution and conversion to alternative uses which largely relate to agriculture and tourism. Between 1992 and 2007 alone Fiji had lost 70,000 hectares of forest cover (Lees, 2007). Loss of mangroves, corals and natural forests would not just impact its main industries of tourism and agriculture but through the loss of biodiversity, the archipelago's overall health is threatened and with it people's livelihoods (Pelling and Uitto, 2001).

[2] Fiji is an archipelago of 332 islands in the South Pacific Ocean. Viti Levu and Vanua Levu are the two main islands and centres of economy.

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require some behavioural change. Indeed Sanderson (2002) has argued that for sound policy making a theory-based evaluation is essential. Examining the motivations behind behaviour, enables us to understand the processes which may subsequently influence behaviour.[3]

Information provision has been a tool used by policy makers to persuade people to adapt their behaviour though this may interact in unexpected ways with intrinsic motivations. According to Nickerson (1998) people tend to seek information that they consider supportive of favoured hypotheses or existing beliefs. They interpret the receipt of information in ways that are biased to those hypotheses or beliefs. He also finds that people will steer away from seeking, perhaps even avoiding, information that would be considered counterindicative to their held beliefs, and may even look for information that is instead supportive of alternative possibilities. If you have a climate change adaptation strategy that involves the dissemination of information – it would be useful to not only ascertain whether it will have an impact on people, but also whether it is correlated with our intrinsic set of motives.

We argue that by better understanding those factors which determine the behavioural outcomes under scrutiny, there is potential for the research to inform the more technocratic side of policy formation through informing targeted policy instruments. By examining how certain behaviours can be achieved research such as this can contribute to closing the gap between the theory and practice of policy making (Nye Jr, 2008).

Novel financing methods are being developed to bridge capital from microloans to the local and global value of intact environmental resources to facilitate environmental stewardship. Considering that climate change adaptation and environmental conservation are underfunded (Gichira et al., 2014; Le Saout et al., 2013) cost effective initiatives such as the provision of information alongside the tools to engage in adaptive behaviour through microloans could potentially enable positive behavioural change. Depending on the type of information provided, it can aid in building adaptive capacity (Neil Adger et al., 2005). According to Knowledge-deficit theory an increase in knowledge will lead to a change in behaviour (Shultz, 2002). Di Falco et al. (2011), in a study that looked at the impact of climatic variables on a farmer's decision to adapt found that better informed farmers in the Nile Basin of Ethiopia had a greater probability to adapt to climate change as they placed less value on the option to postpone adaptation. In addition, they also found that farm households with access to credit had a greater probability to take up climate adaptive strategies. This effect of information and credit access on farmers adaption decisions has been supported by others as well (for instance: Deressa et al., 2009; Nhemachena and Hassan, 2007; and Apata et al., 2009). These studies hint that information, and microloans can be useful instruments to enable more prolific adoption of adaptation measures.

Prompting environmental stewardship through such tools can greatly benefit from psychological perspectives of behaviour. Such a perspective can inform best practice and induce greater behavioural adoption by better visualising the drivers of behaviour. To the best of the author's knowledge, previous research has not examined the cognitive drivers of climate adaptive microloan investment behaviours nor what role information plays in such decisions. Accordingly, we apply the conceptual framework of the TPB to explore the implications of cognitive characteristics on people's decision to adapt to climate change using a novel choice experiment. To the best of the author's knowledge this is the first study employing an experimental procedure to assess the effect of information on the adoption of adaptive investments, and the first experimental study specifically looking at the cognitive drivers of microloan investment choice.

[3] For example, say you want to encourage people in SIDS to grow and eat local foods to enhance food security and curb high food import bills. How do you shift people away from export diets? If you knew what people's attitudes were towards local foods, whether referent others influenced their choice of food, whether they felt like they had any control of what they ate (because they do not cook or food prices are high) then you could understand what sorts of initiatives need to be designed to persuade people to grow and eat local foods.

2. Conceptual framework

The TPB (Fig. 1) is a rational choice-based model wherein one's decisions are assumed to be grounded in subjective utility and cost-benefit rationality (Hübner and Kaiser, 2006). The TPB provides a model of human action and predicts the occurrence of a specific behaviour provided that it is intentional. It states that the constructs of attitudes towards the behaviour, subjective norms and perceived behavioural control will lead to intention to perform said behaviour. Behavioural intention is in turn seen as the primary antecedent of volitional behaviour. This has been supported in meta-analytical reviews (Armitage and Conner, 2001; Ajzen, 2002).

Within the TPB, attitudes refer to the positive or negative evaluation of the behaviour in question (Ajzen, 1991). Attitudes are determined by the total set of accessible behavioural beliefs linking the behaviour to various outcomes and internal accord. Subjective norms refer to the perceived social pressure to perform or avoid a particular behaviour. It includes normative beliefs which concern the perceived probability that important referent individuals or groups will approve or reject a given behaviour and one's motivation to comply to referent others. Perceived behavioural control refers to the perceived ease or difficulty of performing the behaviour in question and is similar to the concept of self-efficacy. It reflects past experiences and future impediments to behaviour. The model requires the constructs within it to adhere to the principle of compatibility, wherein each construct is measured at the same level of specificity (for instance in looking at conservation behaviour one would need to assess attitudes, control perceptions, and subjective norms regarding the particular conservation behaviour of interest).

The importance of the various constructs of the TPB has been shown to differ when looking at different target variables. For instance, in a study looking at transferium (i.e. park and ride) use, De Groot and Steg (2007), found attitudes were the best predictor of intention, followed by perceived behavioural control and subjective norms. In contrast Godin and Kok (1996), in a review of the application of the TPB to health related behaviours, found that attitudes and perceived behavioural control were most often the best predictors of behavioural intention. They also found support for intention being the most proximal determinate of behaviour whilst half the studies in their sample also showed that perceived behavioural control directly influenced behaviour. In a study looking at household recycling, Terry et al. (1999) found that people who identified less with a group (in this case their neighbourhood community), had a stronger relationship between perceived behavioural control and intention. Whilst for people who identified strongly with a group, subjective norms were a greater predictor of behavioural intention.

One of the draws of the TPB in regards to environmental behaviour is in the incorporation of influences beyond one's control. This assumes: 1) the predicted behaviour must partly be beyond volitional control and 2) how one perceives control should reflect actual behavioural control. Whilst the latter assumption has been contested as a flaw within the theory, the former fits well within the ecological domain (Kaiser et al., 2005). The theory has been applied widely to specific environmental behaviours such as recycling (Tonglet et al., 2004; Nigbur et al., 2010; Cheung et al., 1999) conservation technology adoption (Lynne et al., 1995; Lam, 2006) and environmental activism (Fielding et al., 2008) – these studies have had mixed results when considering the strength of the moderating variables however generally it is found that intention is a strong predictor of behaviour. The TPB has had some limited application in the Global South, where it has been used to probe the use of health protective behaviours such as condom use (Schaalma et al.,

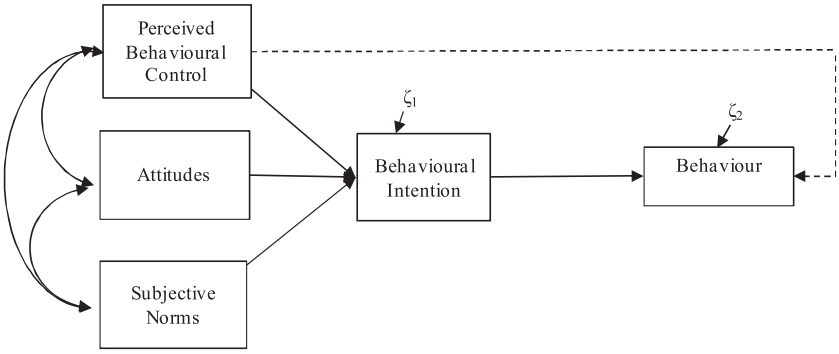

Fig. 1. The Theory of Planned Behaviour.

2009; Molla et al., 2007; Bryan et al., 2006).

Recently studies have applied the TPB to various aspects of micro-banking. For instance, Nance (2013) looked at microfinance tourism, whereby tourists invest in micro-entrepreneurs or microfinance organisations. She applied the TPB to understand the investor's perspective in continued investment following the end of their vacation. She found perceived behavioural control and attitudes to be strong predictors of investment intention. Jebarajakirthy and Lobo (2014) applied the TPB to youth's intentions of seeking microloans in post-conflict zones in Sri-Lanka. They found that whilst positive attitudes and subjective norms improved behavioural intention, perceived behavioural control and knowledge of microloans did not. To the best of the authors' knowledge no study has yet applied the TPB to investigate climate adaptive investment behaviour. For such a prolific development tool, relatively little is understood about the cognitive drivers behind microloan investment behaviours. So here we try to address this gap that by asking:

What are the antecedents of stated adaptive investment behaviour?

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  - According to the Theory of Planned Behaviour, positive subjective norms, attitudes and perceived behavioural control will lead to positive intention to perform a behaviour.
  - As such we hypothesize that positive set of intrinsic motives would be reflected in positive intentions to conserve and protect natural ecosystems.
  - As intention is the most proximal determinant of behaviour – we hypothesize that positive intentions will increase the probability of choosing adaptive over non-adaptive investments.

What is the effect of information on stated climate change adaptative investment Behaviour?

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  - According to knowledge deficit theory access to information will allow people to make better informed choices - therefore providing information on the benefits of adaptive behaviour may be reflected in more adaptive stated behaviour. Thus, our hypothesis is that information will increase the probability of choosing adaptive investments.

3. Design

Stratified sampling was employed with the population being divided into geographical groups consisting of villages close to or within fragile ecosystems. The specified areas were: Koroyanitu protected area and highlands, Coral Coast marine protected area, Navua, Nausori, the Rewa delta and Colo-i-Suva reserve. Within each strata, respondents were randomly selected with a random number sheet.

The psychological constructs of Attitudes Towards Conservation (A), Subjective Norms (S), Perceived Behavioural Control (P) and Behavioural Intention (B), were informed by the Theory of Planned Behaviour (Ajzen, 1991). The final scales omitting those items removed for internal consistency and reliability, consisted of a 9-item Attitudes Towards Conservation scale (α = .73), a 9-item Subjective Norms scale (α = .87) a 5-item Perceived Behavioural Control scale (α = .61) and a 3-item Behavioural Intention scale (BI; α = .90). Each item was measured on a 5-point Likert scale.). Each item was measured on a 5-point Likert scale.

The scales items were reverse coded where appropriate and aggregated to create a summative scale which was coded to create a categorical variable with three categories to reflect high, medium, and low values as appropriate.

The items were constructed to ascertain protective beliefs, norms, and intentions regarding the environment. They were used to ascertain internal motives - to take up investments that were not only adaptive but also protective of natural ecosystems. The sustainable use of natural resources which the survey questions assess may be seen as divergent from the specificity argument of the TPB, however we argue that investment choice as described in the ensuing experiment acts as a proxy to the 'end' behaviour - the sustainable use and protection of the forest/river ecosystems. These were the natural ecosystems that were in proximity to the sampled population. In addition, this allowed us to control for response and acquiescence bias to a certain degree. If we asked questions relating to the intended use of the microloan for sustainable investments then during the choice experiment, we risk diluting actual stated preference by artificially leading respondents to a choice.

The experiment was carried out following the administration of the surveys. The experiment was designed to collect data on environmentally protective investment preferences. A high-level summary of the experiment is presented in Fig. 2.

Respondents were randomly assigned into a control group and a treatment group. The treatment group consisted of talking respondents through a climate change information leaflet, whilst the control group received no such information. The one-page leaflet described what climate change is, how it impacts people in Fiji and what small farmers could do to increase resilience.

The experiment started by setting the scene. Respondents were asked to imagine themselves as a smallholder farmer with their plot being near the closest forest/river ecosystem in the region. They would

Investment Choice	Loan Conditions
There are two lending periods. Respondents selects an Investment choice for each of the two lending periods	*Determined by investment choice*
Adaptive	• Interest ("i") = 20%
Mixed	• Loan maturity ("M") = 8 months
Non-Adaptive	• Required principal repayment ("P") =100%

Fig. 2. Framed Field Experiment High Level Summary.

be offered a microloan to invest in their farm.

Respondents started the experiment with a hypothetical loan of F $300[4] with a flat interest rate of 20%[5] on the principal. This loan could be used to invest in one of three agricultural strategies which are determined by their investment choice and was explained to them with the help of the information cards and mangrove and vertiver hedge leaflets. Investment choices are outlined in Fig. 3.

The method in which returns would be calculated would be affected by random climate attributes. The latter was divided into good and bad seasons and was determined by a die roll. A roll of 1, 2 or 3 represented a good season (for instance: good soil fertility from appropriate rainfall and optimal temperature for crop production). A roll of 4, 5 or 6 represented a bad season (for instance: extreme climate events such as erratic rainfall, drought, and increased severity of flooding). A number value was assigned to translate the impact that the investment choice will have on the ecosystem. A high value was a positive impact and a low value was a negative impact.

The subsequent outcome variable for analysis was coded from 1 to 5, which combined the investment choices across the two collection periods (Fig. 4). This coding represented all the possible combination of investments the respondent could have chosen as depicted in the following matrix and table of investment portfolios (Table 1):

3.1. Empirical method

The analysis method consisted of two subsets of Structural Equation Modelling (SEM). Such modelling utilises a series of statistical methods (such as Analysis of Variance, regression, and factor analysis) to investigate complex relationships between multivariate data. This type of modelling has two components, a structural model and a measurement model. The measurement model is a Confirmatory Factor Analysis which estimates a continuous latent variable based on observed indicator variables. Once the factorial structure of the underlying constructs is validated the relationships between latent variables and other factors is examined. This forms the structural component. One of the main features of SEM is to compare the model to empirical data (Nachtigall et al., 2003). The ensuing comparison results in fit-statistics which enables as to assess how well the model and data match.

The first method used in this study is path analysis. In SEM, the causal relationships amongst unobserved latent variables are defined by a set of equations. In path analysis causal relationships amongst observed variable are defined instead. The second method was a full SEM. This latter was employed to assess whether the use of composite scores is appropriate. With the small sample size as the complexity of models increases, the use of advanced methods in the SEM toolkit would suffer the same constraints of more typical analysis methods such as Multinomial logistic regression – namely the rule of 10 – which recommends 10 cases per variable (Westland, 2010; Starkweather and Moske, 2011).

The software used was MPlus version 6 software (Muthén and Muthén, 2011) as it is one of the few packages that can handle categorical data in SEM. The main assumptions of such models are: a theoretical basis for model specification, a reasonable sample size ($N = 200$), complete data, continuous and normally distributed endogenous variables. However, with categorical data MPlus uses the Means and Variances Weighted Least Square Estimator (WLSMV) which does not make any distributional assumption regarding the independent variable vectors and can handle correlated errors (Muthen, 1983). It has been shown to be a robust estimator for categorical data (Brown, 2006).

This kind of analysis is popular in the social sciences. It can model complex and multivariate relationships simultaneously, and fit two or more groups. It is the only linear analysis method that allows the complete and simultaneous test of all relationships. This genre of analysis is a confirmatory technique to test theory. It does not imply causality.

In the case of categorical data, when using the WLSMV estimator categorical outcomes are probit coefficients and the sign and significance is reported. However predicted probabilities can be calculated for probit probabilities and is shown in Eqs. (2) and (4).

For this study, to test the hypothesis that intentions are more likely to be enacted if they have been supplemented with climate change adaptation and conservation information, a simultaneous multigroup analysis with clustering at the village level, was specified for the path model and the SEM. The antecedents of behaviour were examined the theoretical framework of the TPB. As with the study of any behaviour, by dissecting the antecedents to behaviour one can ultimately design better initiatives to facilitate behavioural change.

The equations for the Path Analysis can be written as follows:

$$\begin{aligned} \textit{Behavioural Intention} &= \alpha + \beta \textit{Attitudes} + \beta \textit{Subjective Norms} \\ &\quad + \beta_{11} \textit{Perceived Behavioural Control} + \zeta_1 \\ \boldsymbol{\textit{Investment Choice}} &= \boldsymbol{\alpha + \beta \textit{Behavioural Intention}} \\ &\quad \boldsymbol{+ \beta_{21} \textit{Perceived Behavioural Control} + \zeta_2} \end{aligned} \tag{1}$$

$$\begin{aligned} Pr(\textit{Investment Choice} = 1|x_i) &= \Phi(\tau_1 - b_1 x_2 - b_2 x_2 ...) \\ Pr(\textit{Investment Choice} = 2|x_i) &= \Phi(\tau_2 - b_1 x_2 - b_2 x_2 ...) \\ &\quad - \Phi(\tau_1 - b_1 x_2 - b_2 x_2 ...) \\ Pr(\textit{Investment Choice} = 3|x_i) &= \Phi(\tau_3 - b_1 x_2 - b_2 x_2 ...) \\ &\quad - \Phi(\tau_2 - b_1 x_2 - b_2 x_2 ...) \\ Pr(\textit{Investment Choice} = 4|x_i) &= \Phi(\tau_4 - b_1 x_2 - b_2 x_2 ...) \\ &\quad - \Phi(\tau_3 - b_1 x_2 - b_2 x_2 ...) \\ Pr(\textit{Investment Choice} = 5|x_i) &= \Phi(-\tau_4 + b_1 x_2 + b_2 x_2 ...) \end{aligned} \tag{2}$$

Where

$$\textit{Investment Choice} = \begin{Bmatrix} 1 & \textit{Adaptive} \\ 2 & \textit{Moderately Adaptive} \\ 3 & \textit{Mixed} \\ 4 & \textit{Moderately Non} - \textit{Adaptive} \\ 5 & \textit{Non} - \textit{Adaptive} \end{Bmatrix}$$

The Structural Equation Model is represented by the following equation:

$$\begin{aligned} u_{ij}^* &= \beta_j \eta_i + \beta_j \xi_i + \varepsilon_{ij},\ j = 1, 2...q \\ \eta_i &= \alpha + \mathrm{B}\eta_i + \Gamma \gamma_i + \zeta_i \\ y_i &= \nu + \Lambda \eta_i + \varepsilon_i \\ x_i &= \nu + \Lambda \xi_i + \delta_i \end{aligned} \tag{3}$$

Where η is a vector of endogenous latent variables, y is the endogenous indicators, x is the exogenous manifest variables, u is the outcome variable, v is a vector of measurement intercepts, Λ is a matrix of factor loadings, α is a vector of latent intercepts, B is a matrix of the latent variable coefficients, Γ is a matrix of exogenous variable regression coefficients, γ is the exogenous latent variable regression coefficients, ξ is a vector of exogenous latent variables, β is the regression coefficients for the exogenous and endogenous latent variables on the outcome variable and ε, δ, ε, and ζ are error terms.

Thus:

[4] In November 2012 the exchange rate was US$1 to F$1.7852.

[5] The primary driver of microfinance in Fiji is the Government. Currently, microloans in Fiji range in interest rates from: a low of 1.5 per cent (HFC Microfinance Drua Account); mid interest rate of 19 per cent (Bank of the South Pacific); to a higher rate of 25 per cent (Microfinance West).

Investment Choice

	Adaptive	Mixed	Non-Adaptive
Investment components	• Vertiver hedges • Organic fertilizer • Resilient seedlings • Mangrove seedlings for compulsory mangrove restoration	• Chemical fertilizer • Resilient seedlings • Mangrove seedlings for mangrove restoration	• Chemical fertilizer • Chemical pesticides • Resilient seedlings

Returns on Investment - Determined by Die Roll

Good Season	120	225	300
Bad Season	120	75	0

Ecosystem Effects

6 (Good)	3 (Neutral)	0 (Bad)

Fig. 3. Investment Choice.

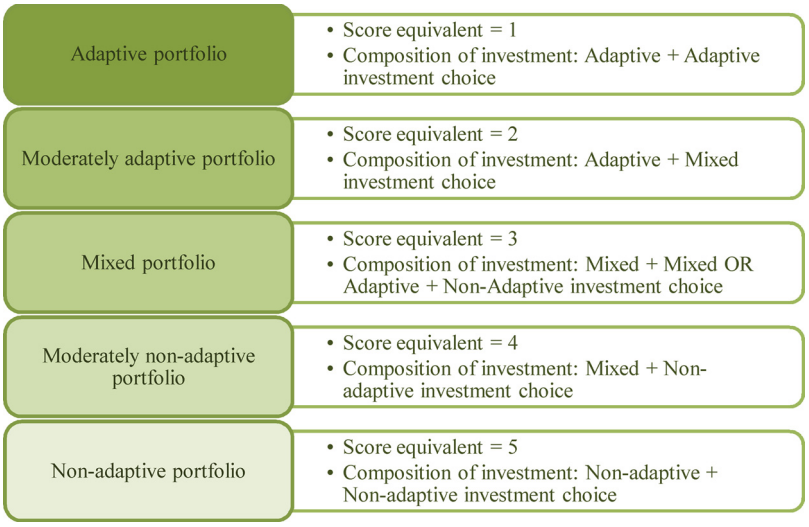

Fig. 4. Possible Investment Portfolios.

Table 1
Matrix of Investment Choices across the Two Collection Periods.

	Adaptive	Mixed	Non-Adaptive
Adaptive	1, 1	1, 2	1, 3
Mixed	2, 1	2, 2	2, 3
Non Adaptive	3, 1	3, 2	3, 3

$$\begin{aligned}
&Investment\ choice_{ij}^{*} = \beta_j \eta_i + \beta_j \xi_i + \varepsilon_{ij} \\
&\eta_{Behavioural\ Intention} = \alpha + B\eta_1 + \Gamma\gamma_i + \zeta \\
&y_{B1-3} = \nu + \Lambda\eta_{Behavioural\ Intention} + \in \\
&x_{A1-10} = \nu + \Lambda\xi_{Attitudes} + \delta \\
&x_{S1-9} = \nu + \Lambda\xi_{Subjective\ Norms} + \delta \\
&x_{P1-6} = \nu + \Lambda\xi_{Perceived\ Behavioural\ Control} + \delta
\end{aligned} \tag{4}$$

Where $B_{1\text{-}3}$, $A_{1\text{-}10}$, $S_{1\text{-}9}$, $P_{1\text{-}6}$ are scale items.

The conditional probability of u = 1 response given the factor η_i and the covariate is given by:

$$P(u_{ij} = 1|\eta_i, x_i) = 1 - \phi[(\tau_j - \beta_j \eta_i - \beta_j \xi_{Perceived\ Behavioural\ Control})\theta_{jj}^{-1/2}] \tag{5}$$

4. Results

The survey and choice experiment consisted of a total of 205 residents living in or near six fragile ecosystems in Viti-Levu. 17 villages were sampled. The sample population consisted of 75.1% Fijians, 24.9% Indo-Fijians, 42.4% females and 57.6% males. The average respondent was 41.6 years old with a range with 19 and 83 years of age. On average, they lived in households consisting of five people and generally were the head of the household[6] (50.7%). The main occupation was farming (45.9%), followed by fishing (31.7%) and the remainder (22.4%) of respondents were in other forms of employment. 35.61% of respondents earned between F$0 and less than F$10 a day. 50.2% earned between F$11 and F$20 a day and the remaining 14.1% earned over $21 a day. In terms of education, 2.9% of the sampled population had no schooling, 18.5% went through some primary school, 16.1% completed primary school, 31.7% went through some secondary schooling, 24.9% completed secondary school, 2% went through a literacy campaign and the remaining 3.9% were in or had completed tertiary education.

Regarding access to microcredit, 20.49% of respondents had no access to microcredit. 39.51% of respondents were microcredit participants. Only 14% of people sampled had access to insurance, whilst

[6] Here household head represents the household reference person

Table 2
Descriptive Statistics and correlations.

Variable	Mean	SD	Min	Max	Frequency		
					1	2	3
Attitudes Towards Conservation	2.102	0.637	1	3	32	120	53
Subjective Norms	2.439	0.620	1	3	14	87	104
Perceived Behavioural Control	1.776	0.601	1	3	65	121	19
Behavioural Intention	2.771	0.455	1	3	3	41	161

Variable	Attitudes Towards Conservation	Subjective Norms	Perceived Behavioural Control	Behavioural Intention
Attitudes Towards Conservation	1.000			
Subjective Norms	0.332	1.000		
Perceived Behavioural Control	0.355	0.082	1.000	
Behavioural Intention	0.318	0.341	0.295	1.000

45.36% had access to savings.

To allow for more direct comparison with the data, scale items were coded 1–3, with 1 being negative, 2 moderate, and 3 being positive. Looking at the descriptive statistics we see that people generally had moderate attitudes ($M = 2.102$, $SD = 0.637$), whilst subjective norms ($M = 2.439$, $SD = 0.620$) and behavioural intention ($M = 2.771$, $SD = 0.455$) tended towards positive. Perceived behavioural intention ($M = 1.776$, $SD = 0.601$) was found to be negative to moderate. The item correlations were weak for subjective norms and perceived behavioural control and moderate between the remaining variables (Table 2).

Looking at the difference in investment choice between the control and treatment groups, the likelihood ratio Chi Square (χ^2 (4, N = 205) = 6.27, p = 0.148) revealed that the treatment and control group was not significantly different from each regarding stated behaviour (Fig. 5). However in the subsequent analysis we see that two groups do differ in regards to behavioural intention.

4.1. Multi-group path analysis with WLSMV estimator

Analysis across groups was run simultaneously. The path diagram for the treatment and control groups are represented in Figs. 6 and 7 respectively. Model fit indexes were selected according to Hu and Bentler's (1999) two-index presentation strategy. We have included the Root Mean Square Error of Approximation (RMSEA), an absolute measure of fit which tells us how well the model, with unknown but optimally chosen parameter estimates would fit the population's covariance matrix – thus it tests a null hypothesis of poor fit. The second is an incremental fit index, the Comparative Fit Index (CFI). The CFI assumes that all latent variables are uncorrelated, comparing the sample covariance matrix with this null model. It tells us the percentage of covariation in the data that can be explained by the specified model. According to Hooper et al. (2008) a CFI greater than 0.95, and a RMSEA less than 0.06 would provide good fit.

A linear constraint was added to the direct effect of perceived behavioural control to behaviour for fitting propensity. Leaving the path unconstrained resulted in a poorly fit Path Model: RMSEA = 0.122; CFI = 0.636. The ensuing overall path model showed excellent fit indicating that the data supported the theoretical model (RMSEA = 0.044, CFI = 1).

We see across both models and groups that the constructs of the TPB were upheld. Positive attitudes, subjective norms, and perceived behavioural control were correlated with positive behavioural intention. Intention, which is hypothesized to be the most proximal determinate of behaviour, only significantly predicted subsequent stated behaviour in the group that received climate change information, with the predicted probability of choosing adaptive investments being 0.502 (Table 3) compared to 0.226 in the control group (Table 4) when behavioural intention was positive. The difference between choosing adaptive and non-adaptive loans was greater in the treatment group (diff = 0.435) then the control (diff = 0.952).

With positive behavioural intention the probability of choosing the moderately adaptive or mixed portfolios was 0.827 and 0.728 respectively in the control group and 0.804 and 0.716 respectively in the treatment group. The probability of choosing the moderately non-adaptive portfolio was 0.908 in the control group and 0.857 in the treatment group. We also found that intention accounted for more variance in the group that received information then not ($R_2 = 0.498$;

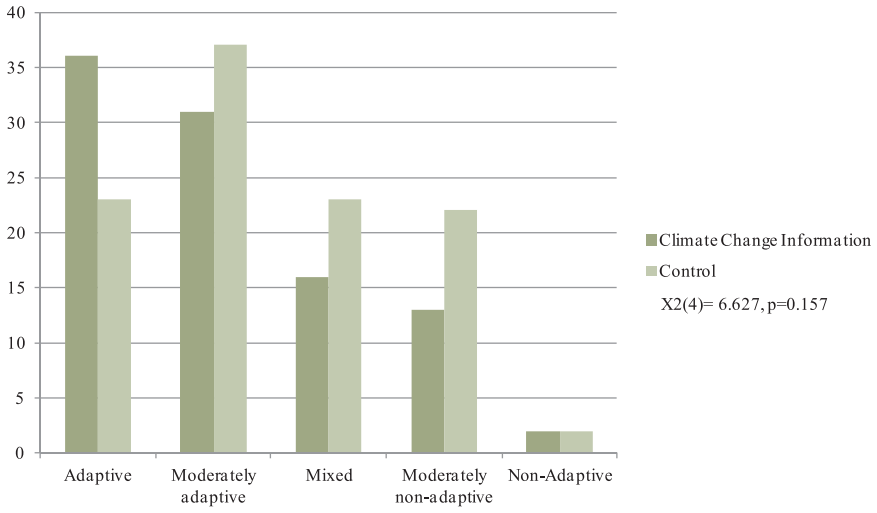

Fig. 5. Frequency Distribution of Investment Choice.

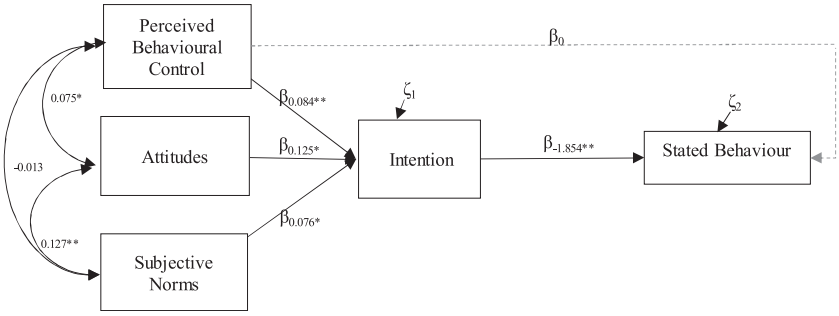

Fig. 6. Path Model for the Group in Receipt of Climate Change Information.

R_2 = 0.402 respectively).

4.2. Multi-group SEM model

The SEM had the same issue as the path analysis in regards to examining the direct effect of perceived behavioural control on stated behaviour. Without constraining this path, the resulting model displayed poor fit (RMSEA = 0.061, CFI = 0.776). For the constrained model, the RMSEA showed adequate fit (RMSEA = 0.058), however the CFI did not (CFI = 0.707). Thus the path Analysis was a better fitting model. The results of the two types of analysis however were similar.

The measurement model showed that the measured variables accurately reflected the desired latent constructs. Coefficients of scale measures for the treatment and control groups are depicted in Figs. 8 and 9 next to their constructs. The probability of choosing the adaptive investment portfolio in the treatment group was 0.597 compared to 0.055 for non-adaptive investments. Whilst intention did not significantly mediate behaviour in the control group, the probability of choosing the adaptive portfolio was only 0.159 (Table 5). The difference in variance explained intention on subsequent stated behaviour in the treatment and control groups was also greater (R^2 = 0.616, R^2 = 0.434 respectively). The Control group differed from the path analysis in that perceived behavioural control was not a significant moderator of intention (B = -0.033, p = 0.896) (Table 6).

5. Discussion

How we construct a behavioural response may be impacted by access to information. This study explored whether the receipt of basic information on climate change could influence the uptake of adaptive investments through a Structural Equation Model and Path Analysis. We found that both our models fit the theoretical framework of the TPB.

As theorized, subjective norms, attitudes and perceived behavioural control were positively correlated to behavioural intention which in turn mediated behaviour. For those that received information on climate change (treatment group), we saw a correlation between intention and behaviour. Whilst in the control group, in the absence of information, intention was not a significant moderator of subsequent behaviour. We found that intention accounted for a greater amount of variance in the treatment group compared to the control, and as hypothesized increased the probability of choosing adaptive over non-adaptive investments compared to the control group.

In the treatment group and control groups, the addition of a direct effect of perceived behavioural control on stated behaviour led to a poor fitting model, as such in subsequent analysis this direct effect was constrained. Perceived behavioural control has been shown to be a somewhat problematic construct within the TPB. For instance, Bamberg and Möser (2007), in a meta-analytical review of 57 datasets found that the effect of perceived behavioural control was weaker on actual behaviour then on intention. In addition, the collective action nature of biodiversity conservation and climate change could mean that individual action is seen as futile or insignificant (Gifford, 2011; Oskamp, 2000).

Interestingly in the control group, when people were not exposed to basic information regarding climate change and the benefits of adaptation, perceived behavioural control deviated further from the theoretical model. Firstly, in the SEM we found that there was a negative relationship between perceived behavioural control and intention in the control group (B = -0.033, p = 0.896), whilst this was not the case in the presence of information (B = 0.244, p < 0.001). Whilst in the path analysis we found that it did not positively covary with subjective norms in the information treatment (B = -0.013, p = 0.761) which differed from the control group (B = 0.061, p = 0.007).

In the control group, absence of information removed the significant effect of perceived behavioural control on intention. Howarth et al. (2010) looked at whether information could influence travel behaviour in the UK. They found that perceived behavioural barriers were surmounted through the provision of well-crafted information.

The finding that the probability of choosing climate adaptive over non-adaptive investments was greater when climate change information was presented provides support for the knowledge-deficit theory, whereby an increase in knowledge will lead to a change in behaviour (Shultz, 2002). That the tools to engage in adaptive behaviour were then made readily available via microloans with adaptive investment options would have lifted barriers to behavioural adoption and could have led to better informed and more effective decision making.

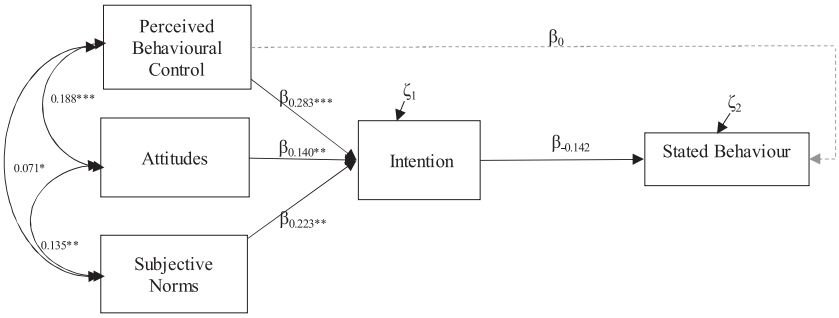

Fig. 7. Path Model for the Control Group.

Table 3
Path Coefficients and Probabilities for Group in Receipt of Climate Change Information.

Group: Climate			β	S.E.	p	
Behavioural Intention	→	Attitudes Towards Conservation	0.125	0.060	0.036	**
		Subjective Norms	0.076	0.029	0.010	**
		Perceived Behavioural Control	0.084	0.040	0.035	**
No Incentive	→	Behavioural Intention	−1.854	0.798	0.020	**
		Perceived Behavioural Control	0	–	–	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.075	0.039	0.051	*
		Subjective Norms	0.127	0.064	0.049	**
Subjective Norms	↔	Perceived Behavioural Control	−0.013	0.043	0.761	

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive

Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.502	0.804	0.716	0.857	0.067

R_2 Behavioural Intention = 0.498; *p < 0.1, **p < 0.05, ***p < 0.001.

Table 4
Path Coefficients and Probabilities for the Control Group.

Group: Control			B	S.E.	p	
Behavioural Intention	→	Attitudes Towards Conservation	0.140	0.050	0.005	**
		Subjective Norms	0.223	0.044	0.000	***
		Perceived Behavioural Control	0.283	0.053	0.000	***
No Incentive	→	Behavioural Intention	−0.142	0.207	0.493	
		Perceived Behavioural Control	0	–	–	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.188	0.040	0.000	***
		Subjective Norms	0.135	0.067	0.044	**
Subjective Norms	↔	Perceived Behavioural Control	0.071	0.026	0.007	**

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive

Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.226	0.827	0.728	0.908	0.131

R_2 Behavioural Intention = 0.402; *p < 0.1, **p < 0.05, ***p < 0.001.

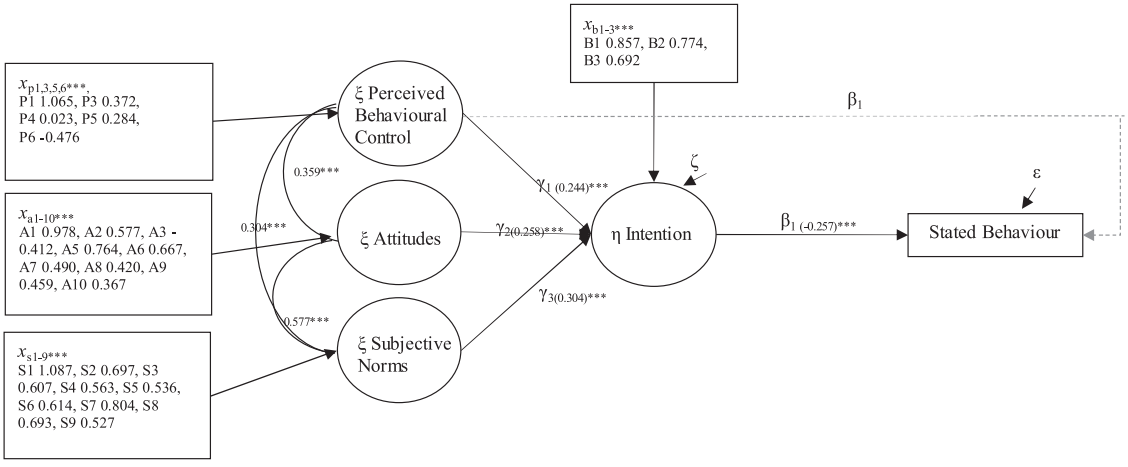

Fig. 8. SEM for the Group in Receipt of Climate Change Information.

Information followed the survey instrument so we cannot make any causal links but hazard to conjecture that it did perhaps strengthen cognitive motivations.

Grothmann and Patt (2005) note that when looking at climate change adaptation behaviour, it is important to distinguish between intention and actual adaptive behaviour because of a lack of objective adaptive capacity when intention perceptions are formed. Objective adaptive capacity includes things like time, money, knowledge, and support. Consequently, there may be a disconnect between when adaptive intentions were conceived and subsequent adaptive behaviour. Accordingly, when comparing the control and treatment groups, we may say that the absence of information was detrimental to ensuing adaptive investment behaviour.

6. Conclusions

In order to increase community's climate resilience, it is important to consider the cognitive antecedents of behaviour. The effect of information found in our study is crucial as it shows that it was sufficient in encouraging people to take up adaptive investments. The findings

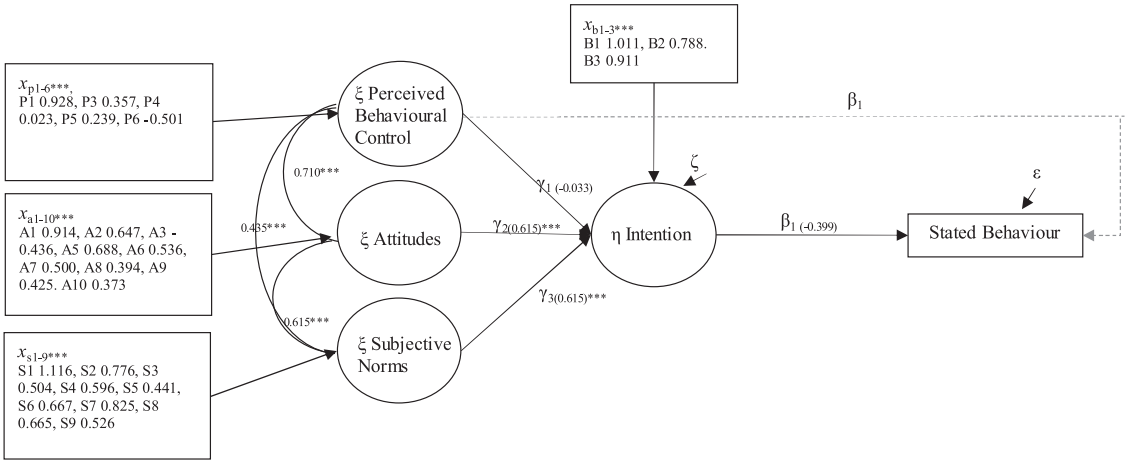

Fig. 9. SEM for the Control Group.

Table 5
SEM Coefficients and Probabilities for Group in Receipt of Climate Change Information.

Group: Treatment			β	S.E	p	
Behavioural Intention	⟵	Attitudes Towards Conservation	0.258	0.076	0.001	***
		Subjective Norms	0.337	0.083	0.000	***
		Perceived Behavioural Control	0.244	0.067	0.000	***
No Incentive	⟵	Behavioural Intention	−0.257	0.050	0.000	***
		Perceived Behavioural Control	0.000	–	–	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.359	0.076	0.000	***
		Subjective Norms	0.577	0.054	0.000	***
Subjective Norms	↔	Perceived Behavioural Control	0.304	0.087	0.001	***

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive				
Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.597	0.909	0.881	0.927	0.055

Behavioural Intention R2 = 0.616; *p < 0.1, **p < 0.05, ***p < 0.001.

Table 6
SEM Coefficients and Probabilities for the Control Group.

Group: Control			B	S.E	p	
Behavioural Intention	⟵	Attitudes Towards Conservation	0.615	0.237	0.010	**
		Subjective Norms	0.323	0.079	0.000	***
		Perceived Behavioural Control	−0.033	0.250	0.896	
No Incentive	⟵	Behavioural Intention	−0.399	0.137	0.678	
		Perceived Behavioural Control	0.000	–	–	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.710	0.116	0.000	***
		Subjective Norms	0.615	0.094	0.000	***
Subjective Norms	↔	Perceived Behavioural Control	0.435	0.082	0.000	***

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive				
Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.159	0.981	0.937	0.996	0.000

Behavioural Intention R2 = 0.616; *p < 0.1, **p < 0.05, ***p < 0.001.

suggest a holistic microloans approach would challenge negative environmental attitudes, strengthen community perceptions and importantly inform of the risks and benefits of conservation and climate change adaptation behaviour in order to encourage people to take up environmentally responsible investments. Microloans which provide adaptive investment options and educate the borrower of climate change and the benefits of adaptation could remove barriers to action. By removing these barriers such micro-lending models can strengthen objective adaptive capacity. Considering this and the results of the choice experiment, it would seem that microloans with adaptive investment options does show promise in meeting the triple bottom line of sound economic, social and environmental impact.

The study has its limitation. The administration of the survey instrument came before the experiment which could have primed people to a certain response. The validity of self-reported data is also a concern. In addition, the small sample size does limit statements of generalisability. Lastly, as a true experimental method was not employed, we cannot infer causality. However, it still offers useful insights. Overall

it was found that the TPB was a useful investigative tool through which to reveal the behavioural antecedents of microloan investment choice in poor communities in SIDS. We found that attitudes and subjective norms were positively related to behavioural intentions regardless of treatment. Stronger attitudes towards conservation and subjective norms were associated with greater intention to behave in a manner that was protective of the forests and rivers.

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